

Construction Site Geometry

Abstract

Interested in implementing cooperative learning, problem-solving, or performance assessment into your geometry course? Students will work in groups to design a corporate park in this activity developed in cooperation with the University of Cincinnati's STEP program. Each team has to solve problems, perform calculations, and compromise.

Outline of Presentation

- Welcome to Norwood High School
- Explanation of STEP Program
- Overview of Construction Site Geometry Lesson
- Sample Problems for Each Group
- Scoring Rubrics
- Samples of Student Work (with rubrics)
- Contact Information
- Questions?

Contact Information for Presenters

- Mrs. Sara Garrison
Mathematics Teacher, Norwood High School
garrison.s@norwoodschoools.org
(513) 924-2891
- Mr. Brad Hunt
Mathematics Teacher, Norwood High School
hunt.b@norwoodschoools.org
(513) 924-2870
- Mr. Neil Wiggerman
NSF Fellow, University of Cincinnati STEP Program
newiggermann@yahoo.com
- To access the Construction Site Geometry lesson plan and documents, please visit <http://homepages.uc.edu/~wiggerne/ConstructionGeometry.htm>
- To access the PowerPoint presentation from today, please visit mathalicious.pbworks.com and request access. This is Sara's wiki page for her class and once access is granted, you may access the PowerPoint under the Geometry tab

Construction Site Geometry

Nike has decided to spin-off a new company that designs and builds designer sports sneakers. As a new employee, you will be working in groups to generate a design for the layout of the construction of a new building, your company headquarters. You will use many of the concepts you have been learning in geometry (Slope, perimeter, area, similarity, trigonometry). Different teams will have different criteria they must meet to be considered successful. Your class as a whole will have to work together to meet the needs of each group. Please solve your problems IN ORDER unless you are waiting on information from another group.

SHIPPING & RECEIVING

You are the shipping and receiving group. Your group keeps the company running by making sure raw materials and supplies arrive when needed, and finished products leave when they are complete. With the construction of the new building, you are very concerned about creating a design that allows the steady flow of deliveries and shipments to move unobstructed. A poor design could bog down production and cost hundreds of thousands of dollars.

5. The main road that borders the property is 3 ft above the height of the building site, which is mostly flat. (See the Property Layout Details *attached*)
 - The steepest allowable slope for the truck is 5 degrees.
 - Draw a side view or views that show the design for the slope of the roadway from the main road to the flat building site. These drawings will assist the construction crew and should be to scale.

HUMAN RESOURCES

As the human resources group, it is your job to ensure that all of the employees stay happy and keep the company strong and capable. With the construction of the new building, you have been tasked to weigh in on some of the issues that are near and dear to the employees' hearts. Proper layout of the company's parking will make employees' lives easier, safer, and will keep visitors and executives happy. If you fail, the company's workers will relive your mistake every day.

7. How much asphalt must be purchased to build the employee parking lot and drive? (*Assume that your parking lot dimensions are 217 feet by 498 feet, your drive is 575 feet by 25 feet, and the handicap spaces cover an area of 280 square feet as determined by our student group*).
 - The asphalt for the lot and road must be 4 inches thick.
 - Your contractor delivers asphalt in 15-cubic yard capacity trucks. The charge for the concrete is a flat \$250 per truckload.
 - How many cubic yards of asphalt are required?
 - How many truckloads are required?
 - What is the total cost of the asphalt?

FACILITIES SERVICES

Your group literally keeps the place from falling apart. The maintenance of the building and its lot are your responsibility. Your expertise is required during the construction planning to properly design a building that is efficient and easy to maintain. Doing your job right will ensure the company stays up and running.

2. You must design the building to meet the two following criteria:
 - The building should be 50,000 ft² and should have a simple but interesting shape. The CEO does not want to work in a square box of a building! A shape with 8 to 16 corners should be simple to plan but attractive to the eye.

- Arrange the space within the building. Management requires that 60% of the 50,000 ft² building be allocated for production and 40% for corporate office space and must be attached to the main entrance. Arrange the space to meet these criteria. (If you have time, you can come back and add more details later.) Keep in mind your layout will affect the other groups. When your design is complete, draw it to scale on graph paper for submission to the final drawing.

MARKETING

As the marketing group, you make the company money by making the company look good. The image of the company and its products are what help attract the customers and even investors. This image is your responsibility. Your contribution is necessary for the new building construction to make sure that the new headquarters retains the image of success and prosperity befitting our company. A clean, attractive appearance will help with community relations, customer perception, and attraction of investors. If you do your job right your group will bring the money in to the company.

4. The industrial engineers in the plant are overworked and have a work layout problem with which they need some assistance. The first diagram (*see attached*) shows the old layout for shoe manufacturing showing the path an employee would walk while making a shoe. The diagram below shows a revised work layout.
 - How far did an employee work in the old layout when making a shoe?
 - How far will an employee walk in the new layout when making a shoe?
 - If a person is expected to make 10 shoes per hour, how far will he or she walk in an 8-hour day with each the new and the old layouts?
 - Assuming the employees walk 2.5 miles per hour, how much time does the new layout save per person?
 - If the plant employs 50 people to perform this task at \$12.00 per hour, how many dollars of wasted hours have we eliminated?

DAYCARE CONSTRUCTION TEAM

The company can only attract and retain the most capable employees by offering benefits that competitors do not. One such fringe benefit is a state of the art onsite daycare facility. Your group will plan for this important service. A proper daycare will help our company keep our quality employees and set their minds at ease while they work.

7. You need to plan the piping for the wastewater from the daycare center. The sewer main is located below the road running along the property line. Standard plumbing code recommends that a sewage pipe should be sloped at a $\frac{1}{4}$ " downward pitch for every foot of pipe. The horizontal run of sewage pipe should begin 1 foot below the ground at the daycare center.
 - How far of a horizontal distance must the pipe travel from the daycare center to the sewer main? (*Assume that this distance is 275 feet as determined by our student group*).
 - What is the vertical drop for the pipe from the daycare center to the sewer main?
 - How long of a pipe do we need to order that runs from the building to the sewer main?